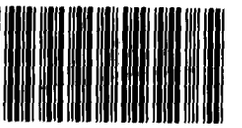
UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

ACCOUNTING AND FINANCIAL
MANAGEMENT DIVISION

~~26315~~

September 28, 1983

B-207974


122483

The Honorable John J. LaFalce
Chairman, Subcommittee on Economic
Stabilization
Committee on Banking, Finance, and
Urban Affairs
House of Representatives

Subject: Interim Observations on Effectiveness of DOD's Manufacturing Technology Program (GAO/AFMD-83-105)

Dear Mr. Chairman:

In response to your request, we are reviewing the effectiveness of the Department of Defense's (DOD's) Manufacturing Technology (MT) Program. During our ongoing review, we have discussed with your staff the complexity of evaluating the overall effectiveness of the MT program because of (1) differing views on the criteria to be applied and (2) the limited information available on how or whether the results of MT projects have been used. Because of these complexities in assessing overall program effectiveness, we agreed with your staff to judgmentally select over 100 individual projects--completed or approved since 1979--in which we would identify and document the results. We have not finished reviewing the selected projects and therefore have not reached conclusions, but we are providing interim observations on MT effectiveness as requested by your staff.

Based on our work to date, it appears that many MT projects have not achieved the primary program goal of improving productivity and reducing Defense acquisition costs. However, there are differing views in DOD and elsewhere on an appropriate approach to evaluating MT program effectiveness. Thus, despite the difficulties in identifying instances where completed MT projects have resulted in verifiable productivity increases and acquisition cost reductions, many DOD officials, defense contractors, and knowledgeable observers consider the MT program highly effective in introducing new or improved technologies. Among the benefits cited is an undetermined degree of spin-off technology use by commercial enterprises.

(910358)

026788

In a 1979 report (PSAD-79-99, Sept. 11, 1979), we expressed concern about the effectiveness of the MT program, noting that (1) many completed MT projects had not resulted in the use of new or improved technology to benefit production of defense items and (2) DOD had never performed a thorough evaluation of the program's effectiveness although it had existed for over 10 years. Since 1979, DOD has used various approaches to partially evaluate the MT program, and has taken several actions to encourage the use of MT project results to benefit defense production.

BACKGROUND ON THE MT PROGRAM

The primary objective of the MT program is to improve productivity and reduce Defense acquisition costs. The program provides funds for demonstrations of new or improved manufacturing processes, techniques, or equipment in defense contractor and DOD-owned manufacturing facilities. It tries to encourage defense contractors and DOD plants to implement or use the results of these demonstration projects in the production of equipment. A side benefit from the MT program is that new or improved technologies are sometimes adopted by commercial enterprises.

The MT program was funded at $142 million in 1983; funding is expected to increase to $210 million in 1984 and continue to increase each fiscal year through 1988. At any time, several hundred ongoing MT projects involving a wide range of technologies are being managed by the three military services.

The MT program is managed primarily by the military services through centralized program offices and engineering support staffs. Program offices are located in the Naval Material Command, the Air Force Systems Command, and the Army Materiel Development and Readiness Command. Some major subordinate commands also have small MT program offices. Above the service level, the Under Secretary of Defense for Research and Engineering maintains a small staff to provide policy guidance and general oversight for the program.

A DOD-sponsored Manufacturing Technology Advisory Group, comprising representatives from federal agencies and industry associations, assists in coordinating and promoting the program. The group's structure is one of several mechanisms which provide opportunities for commercial enterprises to obtain information on new or improved technologies generated under the MT program. Other mechanisms which can disseminate MT results for possible commercial use include end-of-project demonstrations and various technical publications.

GAO'S EARLIER REPORT ADDRESSED MT EFFECTIVENESS ISSUE

In our 1979 report, we expressed concern about the lack of a thorough evaluation of the MT program by DOD, and about the fact that many completed MT projects had not benefited the production of defense items.

At that time, although the program had been in existence over 10 years, no one could fully document its benefits. We did note that Defense journals and publications had featured MT-generated advances in the manufacturing state-of-the-art that were considered to have benefited the defense community and provided spin-off benefits to industry at large.

To meet the program's primary objective of reducing defense acquisition costs through the application of new or improved technology, the results of MT projects must be used in the production of defense items. We found in 1979 that many completed MT projects had not been implemented in a defense production environment.

In responding to our 1979 report, DOD officials said that they believed the program was providing substantial payback, based on sporadic success stories with unaudited estimates of savings. DOD officials said it might not be cost effective to measure the benefits from each and every project over an extended period and through all tiers of implementation. Our position was that there should at least be a plan for implementing MT project results into the production of the system the project was intended for.

DOD ACTIONS ON PROGRAM EFFECTIVENESS SINCE 1979

DOD and the military services have acted since 1979 to

--increase the probability that MT project results will be used in production and

--evaluate, in various ways and to varying degrees, the results achieved under the MT program.

As part of our ongoing review, we are attempting to determine whether further evaluation efforts would be both warranted and practical.

Implementation

Since 1979, the military services have taken various steps to increase the likelihood that the results of Manufacturing Technology projects will be used to benefit the production of defense systems. The steps taken, however, only increase the probability that defense systems will benefit from MT--there is no guarantee.

All three services, for example, now require that an implementation plan be prepared before an MT project is completed. Implementation plans encourage the use of MT project results in production by linking projects more directly with specific production requirements. The Navy requires an implementation plan 3 months before project completion. The Air Force and Army require a preliminary implementation plan at project initiation which is updated and made final when the project is completed.

Beginning with fiscal year 1982 MT projects, the Navy requires that a "memorandum of understanding" be signed by MT officials and responsible acquisition managers before projects are funded. These memoranda are intended to ensure that acquisition managers understand the anticipated benefits and are willing to implement MT project results in the systems they are acquiring.

Further managment actions regarding implementation may be necessary since the results of many projects still do not directly benefit the production of Defense systems. Office of the Secretary of Defense (OSD) officials in 1981 and again in 1982 reiterated the need to ensure that the results of the MT projects are used in the production of defense systems. As part of our ongoing review, we are seeking to identify additional management actions needed to encourage implementation.

Evaluation

All services have taken some actions to identify how results of Manufacturing Technology projects are used after project completion. However, the efforts to assess the results of completed projects vary, and are subject to differing interpretations.

The Army, for example, has conducted annual surveys since 1979 to determine the benefits derived from completed projects. The results of these surveys are summarized and distributed to interested parties in and out of DOD. While the Army's evaluation efforts are more comprehensive than those of the other two services, the Army's reports can be misunderstood without reviewing the reporting instructions. For example, "implemented" projects include projects available for implementation and planned implementations, as well as those actually in use.

In 1983, the Navy assigned its program support staff the responsibility to track and assess the benefits of completed projects. In the same year, on a special one-time basis, the Navy inventoried the status of all the projects it had funded since 1977.

In April 1982, the Air Force contracted with a private company to assess the technical results, implementation, and resulting benefits of 77 completed MT projects at nine contractors'. The final results of this assessment are not yet available.

OSD has also attempted to demonstrate program benefits. For example, it requested both in 1982 and 1983 that the military services identify their "top 10" success stories. Our ongoing review includes an attempt to substantiate selected results of these two efforts.

Despite evaluation efforts by the military services and OSD, DOD still has no uniform system to readily ascertain how the results of all completed projects were used and what actual

benefits were realized. The evaluation efforts differ in regard to (1) approach and methodology, (2) criteria used to judge effectiveness, and (3) interpretation of results collected.

SOME GAO OBSERVATIONS ON SELECTED PROJECTS COMPLETED OR APPROVED SINCE 1979

In our ongoing review, we are examining in detail over 100 individual MT projects completed or approved since 1979. We selected the projects from all three services, and they represent a diversity of technologies. Because we selected the sample judgmentally, we will not be able to say that these particular projects are truly representative of the total program. However, we do believe descriptive information we are developing, and our observations on the selected projects, will provide very useful insights into the nature of the MT program and on some results it is achieving and not achieving.

Because of your particular interest now in MT program results, we are enclosing--in draft form--descriptive information on 30 projects DOD completed since 1979. The schedule provides information on 10 projects--5 implemented, 5 not implemented--from each service. Our final report will include more comprehensive information on all of the selected projects we are reviewing.

Some of our initial observations on projects completed and approved since 1979 follow:

--While it is difficult to generalize about characteristics of projects, many require 2 to 3 years or longer to complete.

--Many completed projects are still not being implemented in a defense production environment.

--Completed MT projects were not implemented for a variety of reasons such as lack of technical success or economical feasibility, or a change in defense production requirements.

--When completed projects are implemented, it is usually difficult to substantiate the benefits attained.

--Regarding projects that have not been implemented, defense contractor and DOD officials sometimes express the view that there will be future benefits because of knowledge gained.

TECHNOLOGY DIFFUSION VALUE OF MT PROGRAM HARD TO ASSESS

While the primary goal of the MT program relates to defense production, DOD and the military services have various mechanisms

which provide opportunities for MT-generated technology to be diffused beyond the defense establishment. Specific instances of commercial application of MT ideas can be identified, but practical and cost considerations preclude the systematic and comprehensive identification of all such uses.

Some major mechanisms from which commercial users can acquire MT-generated information are:

--The Manufacturing Technology Advisory Group, comprising representatives from federal agencies and industry associations. Several hundred attendees exchange information at an annual meeting. Also, six technical subcommittees meet at various times to review proposed projects and for other purposes. While this advisory group has several missions, it provides a conduit for information to be disseminated to potential commercial users.

--End-of-project demonstrations. At the completion of each MT project, anywhere from a few to a hundred or more defense contractor, other industry, and government representatives are invited to a briefing on the project results.

--Technical Publications. Each military service issues several technical publications which discuss ongoing and completed MT projects. The publications are available to commercial enterprises.

In addition, DOD is attempting to establish an MT information analysis center to more effectively transmit MT project results to defense contractors and others in the public and private sectors. The center would be similar to nine other information analysis centers now managed and funded by the Defense Logistics Agency and the Defense Technical Information Center. These contractor-operated centers collect, analyze, and store available information on highly specialized, technical areas. The information is then repackaged and disseminated to users in the public and private sectors.

During our ongoing review, we occasionally identify commercial applications of MT-generated technologies. However, complete information on commercial applications of MT-generated technologies is not collected or maintained by DOD.

MT PROGRAM ENJOYS STRONG CONTRACTOR SUPPORT

The MT program appears to enjoy solid support from the defense contractor community. Virtually all of the contractors we have contacted believe the program is beneficial. One view, for example, is that--even where near term, tangible benefits are not evident--the knowledge gained will ultimately lead to more efficient manufacturing processes, higher productivity, and reduced acquisition cost to DOD.

Because we have not yet reached conclusions on the results achieved by the MT program, we did not get official comments from DOD but did generally discuss the contents of the letter with Defense officials.

Sincerely yours

W. D. Campbell
Acting Director

Enclosure

ENCLOSURE I

EXAMPLES OF MANUFACTURING TECHNOLOGY PROJECTS IMPLEMENTED SINCE 1979

PROJECT TITLE AND NUMBER	PROJECT SITE(S)	PROJECT PURPOSE	PROJECT TOTAL COSTS	PROJECT DURATION a/ (in months)	INTENDED PRODUCTION APPLICATIONS	BENEFITS PROJECTED: At Project Initiation	BENEFITS PROJECTED: At Project Completion	ACTUAL PRODUCTION APPLICATION	BENEFITS IN PRODUCTION: AS REPORTED	BENEFITS IN PRODUCTION: BASIS	OTHER IDENTIFIED USES OF THE TECHNOLOGY
Army						Army					
Automated Equipment for Assembly of M739 Fuze (4032).	Picatiny Arsenal Dover, NJ. Honeywell Inc., Hopkins, MN.	Make available a prototype automated assembly high speed production line capable of producing 100,000 fuzes per mo.	$1,335,000	46	105mm, 175mm, 4.2 inch and 8 inch weapon systems.	Cost reduction ($.32 per unit), decreased need for skilled operators/inspectors, reduced space needs, less material handling, and intangible benefits.	Not identified.	Honeywell produced 2.2m fuzes using the machinery beginning February, 1974 until May, 1981 when machinery was laid away because of low requirements.	No savings reported. Benefits: 1. Improved product quality/reliability, 2. Lead time reduction, 3. Improved readiness.	Cost saving possibly realized but apparently not measured. Other benefits plausible but not substantiated by GAO. Production facilities not visited.	Two other contractors insitituted automated assembly lines for fuze production. One contractor produced 1.4 million fuzes but has laid away the equipment due to unsuccessful bid on subsequent procurement. The second contractor reportedly is still producing fuzes.
Controlled Production Loading System for 105mm HEAT-T M456A1 (4163).	Mason & Hanger, Iowa AAP, Middletown, IA. Martin-Marietta Milan AAP, Milan, TN.	To develop processes, techniques and equipment for successfully loading the 456 projectile.	$843,000	29	105mm HEAT T-M456 and other cartridges.	$29.57 million discounted 10 year savings (Reduce rejected rounds from 30-50% to 5%). R.O.I.:502% S.I.R.:47.5	Not identified.	The prototype equipment was installed at Milan AAP and has been used on a production basis for loading the M456 since October, 1980.	Manufacturing cost reduction ($25,688 million projected cost savings), ability to produce, improved product quality and reliability.	Not substantiated. Contractor stated that rejected rounds had been reduced to 3% but had made no attempt to translate this reduction into cost savings.	None.
Recyling of Scrap Gun Tubes by Rotary Forging (7727).	Watervliet Arsenal, Watervliet, N.Y.	To rotary forge fired out or demilitarized gun tubes without intermediate remelting and casting.	$461,000	48	Various cannon gun tubes.	Savings up to 80% of the new material purchase cost. 10 yrs. discounted savings of $5,559,000 (mobilization) and $6,172,460 (production).	Not identified.	Implementation was initiated at Watervliet Arsenal in April, 1980 for manufacture of 105mm M68 tubes. Implementation was discontinued after 3-4 months because of only 50% success Rate. Re-implementation is being evaluated.	Cost reduction ($716K discounted savings projected), energy conservation, improved readiness.	Projection based on 80 tubes a year resulting in savings of $1,267 per tube.	None.
Determination and Certification of an "In-House" Armor Steel Casting Process (7340).	Rock Island Arsenal, Rock Island, IL. Aberdeen Proving Ground, Aberdeen, MD.	Obtain certification of an "in-house" armor steel casting process to resolve difficulties in procurement of armor stell castings.	$83,000	66	M127 gun mount components and other armor steel components.	Not identified.	Not quantified. Project resulted in alternative source of supply at competitive rates and alleviated pre-existing procurement problems.	M127 Gun Mount components.	Non-quantified benefits: -ability to produce, -lead time reduction, -sole source elimination.	Not documented Ability to produce considered "key" benefit. Cost savings may have resulted but no assessment of benefits was made.	None.
Synthetic Quenchants for Heat Treating Weapon Components (7814).	Rock Island Arsenal Rock Island, IL. Marvalaud, Inc. Westminster, MD.	Improve heat treatment of complex steel and aluminum alloy work pieces by use of improved quenchant materials.	$128,000	26	Production of end items that require rapid cooling from austenitizing or solution treatment procedures during processing including machine gun and tank components.	Non-quantifiable benefits: -improved products, -savings in replenishing, handling, and storage of fire safe quenchant concentrates, -safer working environment, -reduced soil, ground, and water pollution, -reduced oil useage.	-Cost savings of $25,133 per year, -Improved safety/health aspects by not quenching in oil, -More uniform hardness of products.	All ferrous components.	-Safety/health improvement, -Improved product quality/reliability, -Cost reduction ($136,000 discounted 10 year savings).	Cost reduction not auditable. Other benefits reportedly realized.	None.

a/Project duration shown generally represents date MT funds received in the first project year to the end of project demonstration date. Exceptions are that (1) the Air Force start data is the contract award date and (2) the Army's end date is the last project execution month identified in the final project status report.

ENCLOSURE I

EXAMPLES OF MANUFACTURING TECHNOLOGY PROJECTS IMPLEMENTED SINCE 1979

PROJECT TITLE AND NUMBER	PROJECT SITE(S)	PROJECT PURPOSE	PROJECT TOTAL COSTS	PROJECT DURATION a/ (In months)	INTENDED PRODUCTION APPLICATIONS	BENEFITS PROJECTED At Project Initiation	BENEFITS PROJECTED At Project Completion	ACTUAL PRODUCTION APPLICATION	BENEFITS IN PRODUCTION AS REPORTED	BENEFITS IN PRODUCTION AUDITABILITY	OTHER IDENTIFIED USES OF THE TECHNOLOGY
Air Force											
Composites Manufacturing Operations Production Engineering 77-C-5018	General Dynamics Ft. Worth, TX	To assess the benefits to be accrued from improved individual manufacturing concepts for advanced composite aircraft structure. Goal is to move to a generic fully integrated manufacturing capability for high volume production of composite components.	$504,000	35	F-16 horizontal stabilizers	Major savings due to decreased labor and material; improve defense industrial base.	Labor savings: 56 percent; material savings; and estimated total savings of $918,000 for 1000 F-16 horizontal stabilizers.	F-16 composite parts.	None formally reported		Boeing
In-Process Controls Inspection During Composite Manufacturing 77-C-5217	General Dynamics Ft. Worth, TX	To establish, demonstrate and validate an integrated system of quality control and inspection for tracking advanced composite structures through a production facility.	$1,376,000	46	F-16	Reduce the costs of manufacturing composites; reduce scrap; improve quality	Estimated savings on F-16 of $5.4 million from reduced scrap, labor, and time.	F-16 composite parts	None formally reported		Vendors of composites use first module; Thicol uses several modules; modules at Rockwell, Lear, Lockheed, and the Sacramento Air Logistics Center.
MT for Electrochemical Machining 76-C-0213	General Electric Cincinatti, OH	Establish an automated electrochemical machining system and a process for generating complex shapes in gas turbine engine components using this automated system.	$1,345,000	36	Air-cooled turbine rotor disks for Advanced Technology Engine Gas Generators	Reduce labor costs and leadtimes	In machining single disks, labor hours were reduced 53 percent. More complex parts can be machined.	While the process is not being used on bore entry colled disks, it is being used on parts for the CFX, T-700, F-15, and F-100 among other systems.	None formally reported		None
Manufacturing Process for Skin Stabilized Composite Structure 78-C-5108	Vought Corp. Dallas, TX	To demonstrate and validate low costs and innovative skin stabilization manufacturing methods for composite secondary structure which is cost-competitive with honeycomb. To demonstrate nonautoclave cure processing techniques. January, 1980, an additional objective added--to develop a repair manual.	$146,000	18	T-38 aircraft - contract was to result in a limited production run of graphite composite trailing edge wedges.	Reduced life cycle costs; be production cost-competitive with currant item	Projected return on investment of 2.1:1 based on 10 year service life of 800 aircraft. Met 400 percent of performance requirements. Need for maintenence greatly reduced.	T-38 aileron trailing edge. 30 ailerons were purchased for testing by Air Logistics Center.	None formally reported		None
Manufacturing Process for Low-Cost Hermetic Chip Carrier 78-C-5147	Texas Inst Dallas, TX	Optimize production processes and techniques required for low cost carrier package and to establish that package as an accepted standard for future military and commercial uses. Must be optimized to be manual and automated processing and testing techniques.	$896,000	38	All military electronics systems	Reduce costs of HCCs; improve reliability, increase use of HCCs	Reduced the use of gold, improved reliability, reduced costs, reduced space and weight (1 board with HCCs equal to 6 regular boards).	We were advised that HCCs (primarily those for memories) are used in the Lantirn, Amraam, JTIDS, F-15, and B-1 programs	None formally reported		Hughes, Rockwell, AIL, GTS, Martin-Marietta

a/Project duration shown generally represents date MT funds received in the first project year to the end of project demonstration date. Exceptions are that (1) the Air Force start data is the contract award date and (2) the Army's end date is the last project execution month identified in the final project status report.

ENCLOSURE I

EXAMPLES OF MANUFACTURING TECHNOLOGY PROJECTS IMPLEMENTED SINCE 1979

PROJECT TITLE AND NUMBER	PROJECT SITE(S)	PROJECT PURPOSE	PROJECT TOTAL COSTS	PROJECT DURATION a/ (In months)	INTENDED PRODUCTION APPLICATIONS	BENEFITS PROJECTED At Project Initiation	BENEFITS PROJECTED At Project Completion	ACTUAL PRODUCTION APPLICATION	BENEFITS IN PRODUCTION AS REPORTED	BENEFITS IN PRODUCTION BASIS	OTHER IDENTIFIED USES OF THE TECHNOLOGY
Navy											
Gallium Arsenide Substrate Fabrication (DNA 00650)	Microwave Associates, Inc. Burlington, Mass.	Establish domestic, production capabilities for fabricating high quality gallium arsenide wafers.	$501,000	34	U.S. electronics manufacturers	$3,500,000 savings per year. Expansion of defense industrial base.	No projection made	Microwave Associates Burlington, Mass. F-18 Aircraft, Standard ARM, AIM-9L, AAMRAM and Phoenix Missiles	$25,000,000 savings to date Expansion of Defense Industrial Base	Part of savings represent comparison of first run costs using new technology with subsequent runs. Not auditable as actual cost savings.	Some large Weapons System Manufacturers have implemented the technology for inhouse consumption. Some smaller firms have become suppliers.
Delidding and Resealing of Hybrid Microcircuit Packages (DNA 00253)	Westinghouse Baltimore, MD	Providing production and remanufacturing methods for delidding and resealing hybrid microcircuits.	256,000	18	Hybrid microcircuits used in F-14 aircraft, Standard ARM, AIM-9L, AMRAAM missiles and depot repair facilities.	$7,500,000 savings per year. Increase parts availability.	$10,000,000 savings Shorten turnaround time in rework.	Westinghouse Baltimore, Md. Naval Avionics Center Indianapolis, In. Selected microcicuits in several systems	None Reported		Several microcircuit firms have purchased equipment developed under the project.
Automated Test System for Phased Array Antennas (DNS 00475).	RCA, Moorestown, NJ	Develop test set and computer program methods for near-field testing of phased array antennas.	677,000	18	For testing AEGIS SPY-1A radar antennas.	$100,000 savings per ship. Decrease testing.	$400,00 savings per ship Decrease testing time.	RCA Moorestown, NJ. For testing AEGIS SPY-1A radar antenna	$1,200,000 savings to date	Comparison of actual cost to test using new technology with estimates of cost if antenna had to be measured using conventional testing methods.	Other systems manufacturers visited RCA to discuss use of technology on other phased array antennas. RCA is is now expanding on the technology for use on the AEGIS SPY-1B now being developed.
Manufacturing Technology for Cross-field Amplifiers (DNE 00005)	Varian Associates, Beverly, Mass.	Modify or simplify the manufacturing process for cross-field amplifiers to lower production costs.	265,000	28	For use in producing cross-field amplifiers in AEGIS SPY-1A radar system.	$4,416,00 savings or about $4,000 saving per tube	$4,300 per tube	Varian Associates, Inc. Beverly, Mass. For use in producing cross-field amplifiers in AEGIS SPY-1A radar systems.	$2,937,000 savings to date	Cost savings are based on actual price of new tube using new technology compared to estimated cost of tubes using prior processes (adjusted for inflation and and learning curve). DOD purchases the new tubes and supplies them to the prime contractor as government furnished equipment.	Technology being used in development of tubes for AEGIS SPY1B. Use is planned in production of tubes for SPY-1B.
Power Traveling-Wave Tube/Airborne Expendable Device (DND 00024)	Teledyne MEC, Inc. Palo Alto, CA Raytheon, Waltham, Mass.	Reduce manufacturing costs of traveling-wave tubes used in expendable decoy program.	2,239,000	36	For use in producing traveling-wave tubes.	$44,800,000 savings for quantity of 12,000 tubes	$10,000 saving for quantity of 6,000 tubes	Intended project requirement did not exist at end of project. Results applied to other tubes being produced for DOD by Teledyne and Raytheon.	None Reported		none

a/Project duration shown generally represents date MT funds received in the first project year to the end of project demonstration date. Exceptions are that (1) the Air Force start date is the contract award date and (2) the Army's end date is the last project execution month identified in the final project status report.

ENCLOSURE I

EXAMPLES OF PROJECTS COMPLETED SINCE FY 1979 BUT NOT IMPLEMENTED

PROJECT TITLE AND NUMBER	PROJECT SITE(S)	PROJECT PURPOSE	PROJECT TOTAL COSTS	PROJECT DURATION a/ (in months)	INTENDED PRODUCTION APPLICATIONS	BENEFITS PROJECTED AT PROJECT INITIATION	BENEFITS PROJECTED AT PROJECT COMPLETION	REASON(S) PROJECT RESULTS NOT IMPLEMENTED
Army						Army		
Continuous TNT Process Engineering (4237).	Armament Research and Development Command (ARRADCOM), Dover, NJ. Day & Zimmerman, Philadelphia, PA. Illinois Institute of Technology Research Institute (IITRI), Chicago, IL. Radford Army Ammunition Plant (AAP), Radford, VA.	Establish pilot plant to optimize and improve continuous TNT production process. (Revised)	$2,486,000	93	TNT productions.	Cost savings of $2,477,000 per 9 months operating period.	Process improvements (reduced production costs, decreased pollution, greater safety, higher yields)	Apparently a technically unsuccessful effort, (Project halted with transfer of funding to other programs.)
Automated Bag Loading, charge assembly and packout operations (4228).	ARRADCOM, Dover, NJ. Indiana AAP, Charlestown, IN. General American Transportation Corporation (GATX), Niles, IL.	Automate increment bag loading, sewing, propellant charge assembly and packout operations in support of mobilization requirements.	$4,476,000	103	Mobilization production requirements applicable to propelling charges for 8-inch and 155-mm Howitzers.	Cost savings of $4,575,000 annually S.I.R.: 2.08 R.O.I.: 28.37	Reduced labor costs, improved safety, reduced operating personnel and greater mobilization capacity.	Production requirements changed.
Pyrolysis of Army Ammunition Plant Solid Waste (4481).	ARRADCOM, Dover, NJ. Georgia Tech University, Iowa AAP, Middletown, IA.	Use pyrolysis technology to convert plant refuse into usable fuels.	$100,000	22	All munitions items containing propellants, explosives, and/or pyrotechnic materials.	Cost saving of $524,000 annually. (Due to oil savings of 66,000 barrels.)	None.	Pyrolysis technology proven not economically feasible.
Low Cost Reciprocating Screw Molding of Thermosetting Plastic Weapons Requirements (7419).	Rock Island Arsenal, Rock Island, IL.	Manufacturing procedures for injection molding of reinforced and non-reinforced thermoset plastic materials	$110,000	81	All Army weapons systems particularly small arms components.	Cost reduction and improved component performance. (Estimated savings of $170,000 on a component of M16 Rifle)	Potential 30% less manufacturing costs on M16 rifle handguard assembly. Manufacturing capability for high quality components with significantly improved service life.	Handguard for M16 rifle is being redesigned. (Production requirement changed.)
Fabrication of Rubber End Items Using Microwave Equipment (7650).	Rock Island Arsenal Rock Island, IL.	Manufacturing process procedures for microwave vulcanization of rubber end items.	$97,000	46	Rubber items used in current or proposed weapons systems, e.g., obturator pads for cannons.	Cost savings unit of $38.00 per unit of "thick-sectioned rubber end items."	Not identified.	Lack of production requirement.

a/Project duration shown generally represents date MT funds received in the first project year to the end of project demonstration date. Exceptions are that (1) the Air Force start data is the contract award date and (2) the Army's end date is the last project execution month identified in the final project status report.

ENCLOSURE I

EXAMPLES OF MANUFACTURING TECHNOLOGY PROJECTS COMPLETED SINCE 1979 BUT NOT IMPLEMENTED

PROJECT TITLE AND NUMBER	PROJECT SITE(S)	PROJECT PURPOSE	PROJECT TOTAL COSTS	PROJECT DURATION a/ (in months)	INTENDED PRODUCTION APPLICATIONS	BENEFITS PROJECTED AT PROJECT INITIATION	BENEFITS PROJECTED AT PROJECT COMPLETION	REASON(S) PROJECT RESULTS NOT IMPLEMENTED
Air Force								
Advanced Composite Engine Static Structures Fabrication 76-C-5429	Rohr Industries Chula Vista, CA	To establish low cost fabrication techniques for organic matrix composite F-100 engine augmentor ducts.	$165,000	33	F-100 engine augmentor ducts	Lower production cost (170 specific amount cited)	Similar to those cited at project initiation.	Augmentor ducts required engine qualification testing before they can be used in production.
MT for Advanced Rotary Launcher 80-C-0406	Rockwell International El Segundo, CA	To establish manufacturing methods for fabricating efficient hybrid composite/ steel rotary launcher tube structures.	$199,000	16	B-52 nuclear launcher, and Launcher tubes in other . existing and future aircraft	Improved, less costly, and lighter nuclear launcher tubes	A projected 44% savings in fabrication cost because the hybrid steel composite launcher tube is 4,000 pounds lighter than a steel tube launcher.	This was one of two competing projects to meet the B-1's requirements for a multiple rocket rotary launcher. According to Air Force engineers, the other project was selected for implementation as the Air Force viewed it as more successful.
MX/AIRS Heat Exchanger 79-C-5053	Northrop Corporation Hawthorne, CA.	To establish and optimize an economical approach for fabricating the MX/AIRS inertial guidance system spherical heat exchanger.	$331,500	40	MX/AIRS inertial guidance system	Reduce cost of providing heat exchange to well below $4800 unit cost by developing a less labor intensive manufacturing process.	Unknown because final report in process	Technically unsuccessfully, failure to fabrication heat exchangers which met specifications.
Manufacturing Process For Quartz Broadgoods Production 76-C-5215	Woven Structures (HITCO) Compton, CA.	To acquire a manufacturing capability to fabricate and process a high quality 4 & 8 foot widths of 20-harness doubleface satin broadgoods using 7-micron diameter filament.	$648,880	43	Satellites	Provide new capability to manufacture the product	New manufacturing method established	The 7 micron filamet is not commercially available and no source has been found.
Low Cost, Foreign Object Damage Resistant Organic Matrix Fan Blades 74-C-5072	General Electric Cincinatti, OH	Development of "foreign object damage" resistant fan blades which can be manufactured in production quantities on a reliable and reproducible basis at costs lower than their metallic counterparts.	$1,988,000	93	Future A.F. engines C-5A aircraft/TF 39 engines F-103 blade	Low production cost/higher production rate for fan blades Improved engine performance. Reduced life style costs for subsonic aircraft-$10 million/year for fleet of 200 aircraft	Fabrication costs of large composite fan blades of the F103 size could be reduced to 60 to 70% of the cost of titanium blades. Manufacturing technologies used are applicable to other engine composite components.	The project is considered technically unsuccessful because the fan blade did not meet the foreign object damage resistent requirements. However, portions of the technology used in making the fan blades are considered technically successful for other end tems.

a/Project duration shown generally represents date MT funds received in the first project year to the end of project demonstration date. Exceptions are that (1) the Air Force start data is the contract award date and (2) the Army's end date is the last project execution month identified in the final project status report.

ENCLOSURE I

ENCLOSURE I

EXAMPLES OF MANUFACTURING TECHNOLOGY PROJECTS COMPLETED SINCE 1979 BUT NOT IMPLEMENTED

PROJECT TITLE AND NUMBER	PROJECT SITE(S)	PROJECT PURPOSE	PROJECT TOTAL COSTS	PROJECT DURATION a/ (in months)	INTENDED PRODUCTION APPLICATIONS	BENEFITS PROJECTED AT PROJECT INITIATION	BENEFITS PROJECTED AT PROJECT COMPLETION	REASON(S) PROJECT RESULTS NOT IMPLEMENTED
Navy								
Inertial Instrument Inspection and Test (DNA 00491)	Charles Stark Draper Laboratories Cambridge, Mass.	Establish automated inspection and test production station for inertial instrument repair, rework and manufacturing.	$467,000	29	For depot level maintenance activity at Naval Air Rework Facility (NARF) San Diego, CA.	$99,600,000 savings over 20-year period. Increased instrument reliability	Increased instrument reliability. No cost saving projections made.	NARF engineers advised GAO that the contractor elected not to use the resulting technology.
Manufacturing Technology for Radiation Hard Optical Fibers For Aircraft (DNA 00690)	ITT Electric-Optical Production Division Roanoke, VA.	To establish cost effective manufacturing production of radiation hard optic fibers suitable for aircraft.	$317,000	32	Ground Cruise Launch Missiles and future Aircraft	$3,700,000 savings per year	No cost savings projections made.	MT project engineers advised GAO that a more economical fiber became commercially available during the project.
Diffraction Optics (DNA 00711)	Hughes Aircraft Co. Los Angeles, Ca.	To establish production methods for manufacturing diffraction optical elements to reduce costs and improve yield and quality.	$1,196,000	33	Heads Up Display Units (HUD) for AV-8B, F-14, F-18, A-7 and A-6 Aircraft.	$25,000,000 savings per year	Labor hour savings of 30 percent	MT project engineers advised GAO that the program managers for targeted aircraft chose a different HUD.
Boiler Tube Hard Deposit Removal Using Cavitating Water Jet (DNS 00349)	Hydronautics, Inc. Laurel, MD	Apply cavitation nozzle principle to the removal of hard deposits from Naval boiler tubes using standard jet cleaning equipment already in place at Navy facilities.	$167,000	32	For use in Naval Shipyards in repair and overhaul of Navy boilers.	$1,125,000 savings per year	No cost savings projection made	Project was technically unsuccessful for use on boiler tubes.
Improved Method of Installing Boiler Tubes (DNS 00410)	Foster Wheeler Livingston, N.J.	Develop magnetic forming process to expand heavy wall boiler tubes in steam and water drum in order to eliminate the extremely costly process of rolling.	$122,000	38	For use in Naval Shipyards in repair and overhaul of Navy boilers.	$570,000 savings per year	No cost savings projection made	Project was funded with research and development funds and was not intended for immediate implementation. A follow-on MT project was funded in Jan. 1981 to test boilers made with new technology.

a/ Project duration shown generally represents date MT funds received in the first project year to the end of project demonstration date. Exceptions are that (1) the Air Force start date is the contract award date and (2) the Army's end date is the last project execution month identified in the final project status report.

Notes:

1. The projects included in this enclosure all examples of over 100 projects covered in the ongoing GAO review. They do not form a basis for forming judgment of the MT program in its entirety nor judgment of the individual projects. Our final report will include GAO observations which should provide additional insight on these and all other projects included in our review.

2. GAO classified projects as "implemented" and "not implemented" according to whether project results have been actually applied in production as primarily intended. Some projects in the above table, although not implemented in the context of our definition, may have resulted in spin-off applications.